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NOTICES OF NEW WORKS.

Table of the Reciprocals of Numbers, from 1 *to* 100,000, *with their Differences, by which the Reciprocals of Numbers may be obtained up to* 10,000,000. *By* LIEUT.-COL. W. H. OAKES, A.I.A. London: C. & E. Layton. 1865.

The following observations appear in No. 302 of the *Philosophical Magazine*, and as they very accurately describe Colonel Oakes' work, and indicate its merits, we are glad to adopt them in preference to any remarks of our own on the subject.

"In most, if not all tables of reciprocals of numbers," says the writer, "the arrangement hitherto adopted has been to give integral numbers from 1 to n, and the corresponding reciprocals as decimals. In the present table both the numbers and their reciprocals are given without decimal points, which are to be supplied according to circumstances. Advantage is thus taken of the fact that the significant digits of the reciprocals of, for example, 3·7256, 37·256, 372·56, &c., are 2684131; the reciprocals being respectively 0·2684131, 0·02684131, 0·002684131, &c. In other words, Colonel Oakes has arranged his table with a view to the fact that if r is the reciprocal of n, then will $r \times 10^p$ be the reciprocal of $n \div 10^p$. In consequence he has been able to render the arrangement of the table almost identical with that of an ordinary table of logarithms. In fact the only exception is that the differences reckoned in order of the numbers are all negative; as they must obviously be, since, the numbers increasing, their reciprocals will decrease.

"Prefixed to the table are two notices, one describing the arrangement of the table and exemplifying its uses, the other giving a short account of the manner in which the reciprocals of the larger numbers were calculated. A word or two may be said on the latter point.

Let n denote any large number, K the sum of the arithmetical complements of the logarithms of n and $\overline{n+1}$, or

$$K = \log\frac{1}{n.(n+1)}.$$

Also let $d_1, d_2, d_3 \ldots$ denote respectively

$$\log(n+1) - \log(n-1),\ \log n - \log(n-2),\ \log(n-1) - \log(n-3),\ \&c.$$

Now
$$\frac{1}{n-1} - \frac{1}{n} = \frac{1}{n.(n+1)} = \frac{1}{n(n+1)} \cdot \frac{n+1}{n-1}.$$

Therefore
$$\log\left(\frac{1}{n-1} - \frac{1}{n}\right) = \log\frac{1}{n(n+1)} + \log(n+1) - \log(n-1) = K + d_1.$$

Similarly
$$\log\left(\frac{1}{n-2} - \frac{1}{n-1}\right) = K + d_1 + d_2,$$
$$\log\left(\frac{1}{n-3} - \frac{1}{n-2}\right) = K + d_1 + d_2 + d_3,$$

and so on. Of course $d_1, d_2, d_3 \ldots$ are given by a table of logarithms, and are equal for a considerable series of numbers. Hence it is plain that the logarithms of the differences of the successive reciprocals can be obtained by addition, and the calculation conducted in a tabular form. Suppose *n* to equal 62500, then will K equal 408 2330, and the calculation will stand thus:—

Numbers.		Logs. of Diff. of Reciprocals.	Diff. of Reciprocals.	Reciprocals.
	K=	408 2330		
62500		. .	. .	·00001600 0000000
	Diff. of logs.			
62499	139	408 2469	256004	0256004
98	139	2608	12	0512016
97	139	2747	20	0768036
96	139	2886	29	1024065
95	139	3025	27	1280102

"The reciprocals entered in the table are, of course,

1600 000, 1600 026, 1600 051, 1600 077,
1600 102, 1600 128, &c.

"In the same tabular calculation the reciprocals of the half and quarter numbers are found by simple multiplication.

"The chief merit of a work of this kind is, of course, accuracy. To secure this, every precaution seems to have been taken. 'To prevent error,' says Colonel Oakes, 'the co-logarithms were checked independently at each 50th term. In taking out the numbers, the progression of their differences was kept in view, so that no material error could occur. The summation of the differences was checked at every 10th term by a subordinate summation, and by comparison with Barlow's tables; and wherever the seventh figure could be uncertain, it was determined by actual division. Finally, every hundredth term was computed by division. The whole of the calculations were performed in duplicate, and when the proofs were set up from one manuscript they were read with the other; and second and third proofs were also each examined by addition of the printed differences, and by comparison with Barlow's table at each 10th term. Lastly, the proofs were again examined, and the whole table virtually recomputed by summation on the Arithmomètre of M. Thomas de Colmar.'

"It is proper to add that the work was undertaken at the suggestion of Professor De Morgan, who says that it is, as far as he knows, 'the largest which has ever been attempted,' and that 'it is a very useful table, and that its applications are far too little known and thought of.'"

CORRESPONDENCE.

ON MR. STEPHENSON'S THEORY OF OPTIONS.

To the Editor of the Assurance Magazine.

Sir,—As I think it possible that your readers may have had nearly enough of this subject, I will be as brief as I can in my reply to the two points raised in Mr. Stephenson's letter in the last Number of the *Journal.*